

Rocky Flats Environmental Technology Site

4-I60-ENV-OPS-FO.42

REVISION 0

**CHEMICAL CLEANING OPERATIONS
OPERABLE UNIT 2, FIELD TREATABILITY UNIT**

APPROVED BY



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1 PURPOSE

This procedure describes the administrative and operations steps used at the Rocky Flats Environmental Technology Site for chemical cleaning operations for the Operable Unit 2 surface water Field Treatability Unit (FTU) microfiltration membrane filtration section. The Operating instructions include detailed descriptions and instructions for safe chemical cleaning operations.

2 SCOPE

This procedure applies to Environmental Restoration Program Division (ERPD) Operations Support and subcontractor personnel.

This procedure addresses the following topics:

- Automatic cleaning of microfiltration membrane filtration section
- Manual cleaning of microfiltration membrane filtration section
- Disposal of cleaning solutions
- Plugged modules

3 OVERVIEW

This procedure implements the requirements for chemical cleaning of the microfiltration membranes in the FTU treatment facility at the Operable Unit 2. This procedure was established to ensure that the chemical cleaning of the microfiltration membranes in the FTU treatment system is accomplished in a uniform and safe manner.

The microfiltration membrane system is located in Trailer (T) 900A. The FTU treatment facility consists of a surface water collection and storage system, a chemical treatment system, a microfiltration system and a Granular Activated Carbon (GAC) system. The FTU treatment system is contained in three trailers (T900A, T900B, and T900C) and is designed to process 60 gpm of contaminated surface water.

The microfiltration system includes an integral cleaning unit for filter membrane cleaning. The cleaning unit consists of a cleaning tank, water flush tank, and cleaning pump with automatic protective devices to ensure that the pump is operated properly. A Programmable Logic Controller (PLC) and piping with automatically-operated valves integrates the cleaning unit in place with the membrane microfiltration system to perform the cleaning steps in an efficient and safe manner.

Periodic cleaning of the microfiltration membrane filtration section is part of normal operating practice. Routine chemical cleaning to increase filtration flow rate is part of the FTU treatment system's operating schedule. The cleaning cycle varies, depending upon precipitation and the quality of the surface water influent to the system. Cleaning may also be required following an operational upset or inadvertent excursions from the normal operating conditions.

4 RESPONSIBILITIES

4.1 Operator

Operates and monitors the FTU system equipment

Reports abnormal conditions occurrences and incidents to the Shift Foreman

Ensures that visitors comply with the Rocky Flats Plant Operable Unit 2 Field Treatability Unit Health and Safety Plan (HASP)

Completes the required logs and forms

4.2 Responsible Manager

Ensures that all personnel, including subcontractors, are trained and qualified to perform the duties, task, and responsibilities described in this procedure

Ensures that all core and ERPD-specific training has been completed and documented, and that copies of all documentation have been forwarded to the ERPD training files

4.3 Shift Foreman

Responds to and reports all spills in accordance with Hazardous Waste Requirements Manual Section 4.0 1-C49-8WRM-04 Release Response and Reporting

5 LIMITATIONS AND PRECAUTIONS

- Operators shall be trained in the safe handling of all reagents used during chemical cleaning operations of the microfiltration system
- All operators shall receive training on the requirements of the HASP

6 PREREQUISITES

6.1 Field Preparation

Project Manager

- [1] Conduct a pre-shift safety briefing in accordance with the requirements of the HASP covering chemical cleaning operations prior to the chemical cleaning of the microfiltration membranes

Operator

- [1] Ensure that the level in the Equalization Tank is at the low limit before the cleaning of microfiltration membranes

6.1 Field Preparation (continued)

Operator (continued)

- [2] Ensure that the FTU system is shut down in accordance with 4-I59-ENV-OPS-FO.41, System Normal Operations Operable Unit 2, Field Treatability Unit.
- [3] Ensure that the level in the concentration tank TK-8 is at the low limit. This provides sufficient tank capacity to accept the concentrate displaced from the modules prior to cleaning
- [4] Ensure that the cleaning tanks contain the appropriate cleaning solution(s) in accordance with 4-I63-ENV-OPS-FO.45, Chemical Handling and Mixing Operations Operable Unit 2, Field Treatability Unit.

7 INSTRUCTIONS

7.1 Automatic Cleaning

NOTE 1 *Placing the control switch for a valve or pump in HAND will illuminate the control switch indicating the valve is open or the pump is running*

NOTE 2 *Placing the control switch for a valve or pump in AUTO may or may not illuminate the control switch and cause the valve or pump to operate depending on control logic*

Operator

[1] Verify that all appropriate prerequisite actions in Section 6 Prerequisites have been completed and record in the OU2 Operations Log Book

[2] Don the appropriate Personal Protective Equipment (PPE) as required in the HASP

[3] To prepare for AUTO CLEAN perform the following

[A] Verify all pump control switches are in OFF

[B] Verify the following manual valves are CLOSED

- V-2
- V-3
- V-4
- V-5
- V-6
- V-7
- V-29

NOTE *Rinse water that has a high or low pH may need to be transferred to Reaction Tank TK 1 or TK-2 during process operations to avoid pH fluctuations in the Reaction Tank due to residual cleaning solutions in the rinse water. Transfer is described in Step [8][L]*

[C] **IF** Step [8][L] is going to be performed during automatic cleaning operations,
THEN perform one of the following

[a] **IF** transferring to TK-1,
THEN open V-101

[b] **IF** transferring to TK-2
THEN open V-102

[D] Place the Filtrate Transfer Pump TP-11-1 control switch in AUTO

71 Automatic Cleaning (continued)

Operator (continued)

- [E] Verify tank TK-11 contains at least 56 6 in of water The Programmable Logic Controller (PLC) will not let the system enter AUTO CLEAN unless TK-11 contains this minimum amount of water
- [F] Ensure the pH in TK-11 is 6 0 to 9 0 s u
- [G] Verify the following system automatic valves are in AUTO
 - AV-8
 - AV-9
 - AV-11
 - AV-12
 - AV-13
 - AV-14
 - AV-15
 - AV-16
 - AV-17
 - AV-18
 - AV-19
 - AV-30
 - AV-35
- [H] Verify Cleaning Pump CP-1 discharge valve V-10 is OPEN
- [I] Place the CLEANING PUMP CP-1 control switch in AUTO

NOTE 1 *At any time during the automatic cleaning process, a cycle can be temporarily paused by actuating the yellow cleaning cycle hold switch. If the red cleaning cycle stop button is depressed, the cleaning cycle is canceled and to reinitiate a cleaning cycle will require restarting from the beginning of these instructions. It should be noted that specific functions of the cleaning cycle (for example, solids flush, chemical cleaning, water flush) may be accessed by depressing the green CLEANING CYCLE START/STEP pushbutton while the cleaning cycle is paused. Disrupting the automatic cleaning process is not recommended for routine use.*

71 Automatic Cleaning (continued)

Operator (continued)

NOTE 2 *During cleaning there are 5 alarm conditions which will place the cycle in a HOLD condition. Any other alarm conditions will sound as in normal operation but will not affect the cleaning cycle*

- *Low seal water pressure (if CP 1 is running)*
- *Concentration TK 8 high level alarm*
- *Cleaning TK-9 high level alarm*
- *Cleaning TK 10 high level alarm.*
- *Neutralization Tank TK 11 level less than 56 inches*

- [4] Log each chemical cleaning cycle on the OU2 Cleaning Log Sheet (See Appendix 1 for Sample)
- [5] Push the CLEANING CYCLE START/STEP pushbutton to initiate an automatic cleaning cycle
- [6] Observe the following STEP 1 SOLIDS FLUSH (Solids back to TK-8) automatic actions occur in sequence
 - [A] AV-19 closes
 - [B] The following valves open (3-sec time delay for valve actuation. All other automated valves are closed)
 - AV-8
 - AV-13
 - AV-18
 - AV-30
 - [C] Cleaning Pump CP-1 starts and flushes water from TK-10 back to TK-8
 - [D] **WHEN** TK-10 reaches low level
THEN Cleaning Pump CP-1 stops
 - [E] AV-13 closes
 - [F] A 30 min time delay occurs for drain back to TK-10
 - [G] AV-18 and AV-30 close (3-sec time delay for valve actuation)

71 Automatic Cleaning (continued)

Operator (continued)

NOTE *Upon entering the cleaning cycle Transfer Pump TP-11-1 is shut off automatically by the PLC and controlled by the level controls in TK-9, TK-10, TK-11.*

[7] Observe the following STEP 2 CHEMICAL CLEAN (Recirculation to TK-9) automatic actions

[A] The following valves open (3-sec time delay for valve actuation).

- AV-9
- AV-12
- AV-15
- AV-16

[B] Cleaning Pump CP-1 starts and recirculates cleaning solution for 14 min

[C] Cleaning Pump CP-1 stops

[D] AV-12 closes.

[E] A 2 to 30 min. time delay occurs for drain back to TK-9.

[F] AV-15 and AV-16 close (3-sec time delay for valve actuation)

71 Automatic Cleaning (continued)

Operator (continued)

WARNING

A thorough recirculation (at least 3 min) during the WATER FLUSH cycle is required if sodium hypochloride was used as a cleaning agent. Mixing acid and sodium hypochlorite can result in the formation of toxic chlorine gas

WARNING

Inhalation of chlorine gas can be fatal

CAUTION

A thorough recirculation (at least 3 min) during the WATER FLUSH cycle is required if bleach was used as a cleaning agent. Bleach may precipitate any dissolved metal within the membranes and cause plugging

- [8] Observe the following STEP 3 WATER FLUSH (recirculation to TK-10) automatic actions
- [A] The following valves open
 - AV-14
 - AV-17
 - [B] Filtrate Transfer Pump TP-11-1 starts and pumps water from TK-11 until TK-10 reaches full level (TP-11-1 control switch must be in the AUTO position)
 - [C] **WHEN** TK-10 reaches full level
THEN the Filtrate Transfer Pump TP-11-1 stops
 - [D] AV-14 closes
 - [E] The following valves open (3-sec time delay for valve actuation)
 - AV-13
 - AV-18
 - [F] Cleaning Pump CP-1 starts and recirculates flush water from and to TK-10 for 3 min

7.1 Automatic Cleaning (continued)

Operator (continued)

- [G] Cleaning Pump CP-1 stops
 - [H] AV-13 closes
 - [I] A 30 min time delay occurs for drain back to TK-10.
 - [J] AV-8 closes
 - [K] AV-11 and AV-13 open (3-sec time delay for valve actuation)
 - [L] Cleaning Pump CP-1 starts and pumps rinse water to reaction TK-1 or TK-2 until low level is reached in TK-10. This step may be accomplished as needed or the cycle may be interrupted at this point by depressing the CYCLE STOP push button
 - [M] The following valves close (3-sec time delay for valve actuation)
 - AV-9
 - AV-11
 - AV-13
 - AV-17
 - AV-18
 - [9] Adjust the pH in TK-8 to the expected operating range of 9.0 to 10.5 su by the manual addition of lime.
- NOTE** *At the end of the cleaning cycle all automated valves close with the exception of AV-19 which is open during normal operation.*
- [10] Record all activities in the OU2 Operations Log Book.

7.2 Manual Cleaning

- NOTE 1** *Placing the control switch for a valve or pump in HAND will illuminate the control switch, indicating the valve is open or the pump is running*
- NOTE 2** *Placing the control switch for a valve or pump in AUTO may or may not illuminate the control switch and cause the valve or pump to operate depending on control logic*

Operator

- [1] Verify that all appropriate prerequisite actions in Section 6, Prerequisites have been completed and record in the OU2 Operations Log Book.

7.2 Manual Cleaning (continued)

Operator (continued)

- [2] Don the appropriate Personal Protective Equipment (PPE) as required in the HASP
- [3] Perform the following to prepare for manual cleaning
 - [A] Verify all pump control switches are in OFF
 - [B] Verify the following manual valves are CLOSED
 - V-2
 - V-3
 - V-4
 - V-5
 - V-6
 - V-7
 - V-29
 - [C] Verify tank TK-11 contains at least 56 6 in of water
 - [D] Ensure the pH in TK-11 is 6 0 to 9 0 su
 - [E] Verify the PROCESS PUMP PP-8-1 control switch is in OFF
 - [F] Verify the following system automatic valves are in OFF
 - AV-8
 - AV-9
 - AV-11
 - AV-12
 - AV-13
 - AV-14
 - AV-15
 - AV-16
 - AV-17
 - AV-18
 - AV-19
 - AV-30
 - AV-35
 - [G] Verify the Cleaning Pump CP-1 discharge valve V-10 is OPEN
 - [H] Verify the CLEANING PUMP CP-1 control switch is in OFF

7.2 Manual Cleaning (continued)

Operator (continued)

NOTE *During cleaning there are 5 alarm conditions for which cleaning steps should be placed on hold until the abnormal condition is rectified. Any other alarm conditions will sound as in normal operation but will not affect the cleaning*

- *Low seal water pressure (if CP-1 is running)*
- *Concentration TK-8 high level alarm.*
- *Cleaning TK-9 high level alarm.*
- *Cleaning TK-10 high level alarm.*
- *Neutralization Tank TK-11 level less than 56 inches*

- [4] Log each chemical cleaning cycle on the OU2 Cleaning Log Sheet.
- [5] Perform the following STEP 1 SOLIDS FLUSH (Solid back to TK-8) manual actions in sequence at the control panel in T900A
- [A] Place the control switch for the following valves in HAND
- AV-8
 - AV-13
 - AV-18
 - AV-30
- [B] Place the CLEANING PUMP CP-1 control switch in HAND and flush back to TK-8
- [C] WHEN TK-10 reaches low level,
THEN place the CLEANING PUMP CP-1 control switch in OFF
- [D] Place the AV-13 control switch in OFF
- [E] Allow drain back to TK-10 for 30 min
- [F] Place the control switch for the following valves in OFF
- AV-18
 - AV-30
- [6] Perform the following STEP 2 CHEMICAL CLEAN (Recirculation to TK-9) manual actions in sequence at the control panel in T900A
- [A] Place the control switch for the following valves in HAND
- AV-9
 - AV-12
 - AV-15
 - AV-16

7.2 Manual Cleaning (continued)

Operator (continued)

[B] Place the CLEANING PUMP CP-1 control switch in HAND

[C] Recirculate cleaning solution for at least 14 minutes

NOTE *The cleaning period can be extended, depending on the degree of fouling*

[D] After 14 min place the CLEANING PUMP CP-1 control switch in OFF

[E] Place the AV-12 control switch in OFF

[F] Allow drain back to TK-9 for 2 to 30 minutes

[G] Place the control switch for the following valves in OFF

- AV-15
- AV-16

WARNING

A thorough recirculation (at least 3 min) during the WATER FLUSH cycle is required if sodium hypochloride was used as a cleaning agent. Mixing acid and sodium hypochlorite can result in the formation of toxic chlorine gas

WARNING

Inhalation of chlorine gas can be fatal

CAUTION

A thorough recirculation (at least 3 min) during the WATER FLUSH cycle is required if bleach was used as a cleaning agent. Bleach may precipitate any dissolved metal within the membranes and cause plugging

[7] Perform the following STEP 3 WATER FLUSH (Recirculation to TK-10) manual actions in sequence at the control panel in T900A

[A] Place the control switch for the following valves in HAND

- AV-14
- AV-17

7.2 Manual Cleaning (continued)

Operator (continued)

- [B] Place the FILTRATE TRANSFER PUMP TP-11-1 control switch in HAND and fill TK-10
- [C] WHEN TK-10 reaches full level,
THEN Place the FILTRATE TRANSFER PUMP TP-11-1 control switch in OFF
- [D] Place the AV-14 control switch in OFF
- [E] Place the control switch for the following valves to HAND
 - AV-13
 - AV-17
 - AV-18
- [F] Place the CLEANING PUMP CP-1 control switch in HAND
- [G] Recirculate cleaning solution for 3 min.
- [H] After 3 min., place the CLEANING PUMP CP-1 control switch in OFF
- [I] Place the AV-13 control switch in OFF
- [J] Allow 30 min for flush water to drain back to TK-10
- [K] Place the AV-8 control switch in OFF
- [L] Place the control switch for the following valves in HAND:
 - AV-11
 - AV-13

NOTE *Rinse water that has a high or low pH may need to be transferred to Reaction Tank TK-1 or TK-2 during process operations to avoid pH fluctuations in the Reaction Tank due to residual cleaning solutions in the rinse water*

- [M] IF transferring to TK-1,
THEN open V-101
- [N] IF transferring to TK-2,
THEN open V-102.

7.2 Manual Cleaning (continued)

Operator (continued)

- [O] Place the CLEANING PUMP CP-1 control switch in HAND and pump rinse water from TK-10 to reaction TK-1 or TK-2

This step may be accomplished as needed or the cycle may be interrupted at this point

- [P] **WHEN** TK-10 reaches low level
THEN place the CLEANING PUMP CP-1 control switch in OFF

- [Q] Place the control switch for the following valves in OFF
- AV-9
 - AV-11
 - AV-13
 - AV-17
 - AV-18

- [9] **IF** the pH in TK-8 is **NOT** in the expected operating range of 9.0 to 10.5 su
THEN adjust the pH in TK-8 by the manual addition of lime

NOTE *At the end of the cleaning cycle all automatic valves should be in OFF with the exception of AV 19 which is open during normal operation*

- [10] Verify that the following system automatic valves are in OFF
- AV-8
 - AV-9
 - AV-11
 - AV-12
 - AV-13
 - AV-14
 - AV-15
 - AV-16
 - AV-17
 - AV-18
 - AV-19
 - AV-30
 - AV-35

- [11] Place AV-10 in AUTO

- [12] Record all activities in the OU2 Operations Log Book

7.3 Transfer of Cleaning Solutions for Reuse

7.3.1 Transfer of Acid Cleaning Solution and Clean Water Rinses for Reuse

The cleaning solution in TK-9 and the solution in TK-10 are transferred by the Operator to Reaction Tank TK-1 OR TK-2 after use

Perform this step during processing operations to control pH fluctuations in TK-1 OR TK-2

NOTE 1 *Placing the control switch for a valve or pump in HAND will illuminate the control switch, indicating the valve is open or the pump is running*

NOTE 2 *Placing the control switch for a valve or pump in AUTO may or may not illuminate the control switch and cause the valve or pump to operate, depending on control logic*

Operator

- [1] Verify that all appropriate prerequisite actions in Section 6, Prerequisites have been completed and record on OU2 Operations Log Book.
- [2] Don the appropriate PPE as required in the HASP
- [3] Verify open V-10
- [4] IF transferring to TK-1,
 THEN open V-101
- [5] IF transferring to TK-2,
 THEN open V-102
- [6] Verify the SEAL FLUSH WATER PUMP TP-11-2 control switch is in AUTO
- [7] Place the control switches for the following automatic valves in HAND:
 - [A] AV-11
 - [B] AV-12 if transferring from TK-9

OR

 - [C] AV-13 if transferring from TK-10
- [8] Place the CLEANING PUMP CP-1 control switch in HAND to pump solution to the reaction tank.

7 3 1 Transfer of Acid Cleaning Solution and Clean Water Rinse for Reuse (continued)

Operator (continued)

- [9] Avoid overfilling by monitoring the level in the reaction tank being transferred to
- [10] Monitor reaction tank pH if the system is operating and ensure the tank stays within the operating range as specified in 4-I59-ENV OPS FO 41 System Normal Operations Operable Unit 2, Field Treatability Unit
- [11] **WHEN** TK-9 **OR** TK-10 reaches low level
 THEN place the CLEANING PUMP CP-1 control switch in OFF
- [12] **IF** the system is **NOT** operating
 THEN place the SEAL FLUSH WATER PUMP TP-11-2 control switch in OFF
- [13] Place the control switches for the following automatic valves in OFF
 - [A] AV-11
 - [B] AV-12 for TK-9 if placed in HAND in Step [7][B]
 - OR**
 - [C] AV-13 for TK-10 if placed in HAND in Step [7][C]
- [14] Close or verify closed V-101 **AND** V-102

7 3 2 Transfer of Bleach Cleaning Solution and Clean Water Rinse for Reuse

NOTE 1 *Placing the control switch for a valve or pump in HAND will illuminate the control switch indicating the valve is open or the pump is running*

Operator

- [1] Don the appropriate PPE as required in the HASP
- [2] Place electric drum pump in 12 in opening at top of TK-9
- [3] Verify that the drum pump control switch is in OFF
- [4] Plug the drum pump power cord into a 120V receptacle
- [5] Attach a 1 in polyethylene (poly) hose to the discharge of the drum pump
- [6] Run the poly hose from the drum pump into a clean empty 55 gal poly drum

7.3.2 Disposal of Bleach Cleaning Solution and Clean Water Rinse for Reuse (continued)

Operator (continued)

- [7] Place the drum pump control switch in ON and pump contents from TK-9 into the 55 gal drum
- [8] **WHEN** the 55 gal drum is full,
THEN place the drum pump control switch in OFF
- [9] Repeat Steps [6] through [8] until TK-9 is EMPTY
- [10] Fill a five gal plastic container with clean water for flushing the drum pump
 - [A] Open V-99
 - [B] Place the FILTRATE TRANSFER PUMP TP-11-1 control switch in HAND
 - [C] Open V-39
 - [D] Open the hose spigot at the outlet of V-39 and fill container
 - [E] **WHEN** the container is full,
THEN
 - [a] Place the FILTRATE TRANSFER PUMP TP-11-1 control switch in OFF
 - [b] Close V-39 and hose spigot.
 - [c] Close V-99
- [11] Rinse drum pump and hose
 - [A] Place drum pump into the 5 gal rinse water container
 - [B] Rinse exterior of drum pump suction tube
 - [C] Run the poly hose from the drum pump into one of the 55 gal poly drums that has sufficient room to accept approximately 5 gal of flush water
 - [D] Place the drum pump control switch in ON and pump rinse water from the 5 gal container into the 55 gal drum
 - [E] **WHEN** the 5 gal container is empty,
THEN place the control switch for the drum pump in OFF

7.3.2 Disposal of Bleach Cleaning Solution and Clean Water Rinse for Reuse (continued)

Operator (continued)

- [12] Store the electric drum pump in T900B
- [13] Ensure that the 55 gal poly drums containing the bleach solution are labeled for reuse
- [14] Store the 55 gal poly drums containing the bleach solution in a chemical storage connex
- [15] Record all activities in the OU2 Operations Log Book

7.4 Plugged Modules

Operator

- [1] Initiate a work order to have modules cleaned
- [2] Record all activities in the OU2 Operations Log Book

8 RECORDS

Management of all records is consistent with 1-77000-RM-001, Records Management Guidance for Records Sources

Project Manager

- [1] Ensure that the original and one copy of the following quality-related records, as appropriate, are transmitted to the ERPD Project File Center in accordance with 2-G18-ER-ADM-17 01 Records Capture and Transmittal
 - Cleaning Log Sheet(s)
 - OU 2 Operations Log Book
 - Work Orders as required
 - Qualification/Training Documentation as required
 - Occurrence Reports as required

Submission of record copies to the ERPD Project File Center satisfies Administrative Record requirements in accordance with 3-21000-ADM-17 02 Administrative Records Screening and Processing

There are no nonquality records generated by this procedure

9 REFERENCES

Rocky Flats Plant Operable Unit 2 Field Treatability Unit Health and Safety Plan

1-C49-8WRM-04 Release, Response and Reporting

9 **REFERENCES (continued)**

1-77000-RM-001, Records Management Guidance for Records Sources

2-G18-ER-ADM-17 01, Records Capture and Transmittal

3-21000-ADM-17 02, Administrative Records Screening and Processing

4-I59-ENV-OPS-FO 41, System Normal Operations Operable Unit 2, Field Treatability Unit

4-I63-ENV-OPS-FO 45, Chemical Handling and Mixing Operations Operable Unit 2, Field Treatability Unit

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[illegible]

APPENDIX 2

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VALVE POSITION TABLE - NORMAL OPERATION

VALVE NO	VALVE POSITION	VALVE NO	VALVE POSITION
V 1	0	V 58	0
V 2	0	V-59	C
V 3	0	V-61	C
V-4	0	V-64	0
V 5	0	AV-65	OAN
V-6	0	V-66	C
V 7	0	V-67	C
AV-8	C	AV-80	FLOW CONTROL
AV 9	C	V-81	C
V 10	0	V-82	0
AV-11	C	V-83	C
AV-12	C	V-84	C
AV 13	C	V-85	C
AV-14	C	V-86	0
AV 15	C	V-87	0
AV 16	C	V-88	C
AV 17	C	V-89	C
AV 18	C	V-90	C
AV-19	0	V-91	C
V 20	C	V-92	C
V-22	C	V-93	0
V 23	0	V 95	0
V 24	C	V-96	OAN
V 25	0	V-97	C
V 29	0	V-98	C
AV-30	C	V-99	C
V 31	0	V-100	0
V 33	C	V 101	C
V 34	C	V-102	C
AV 35	OAN	V-103	0
V 37	0	V 104	0
V 38	C	V 203	C
V 39	C	V 204	0
V-40	C	V 205	0
V-41	C	V 206	0
V 53	C	V 207	C
V 54	0		
V-55	C		
V 57	C		

KEY 0 = OPEN C = CLOSED OAN = OPENED AS NEEDED

APPENDIX 3

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VALVE POSITION TABLE - SYSTEM SHUTDOWN

VALVE NO	VALVE POSITION	VALVE NO	VALVE POSITION
V 1	0	V 58	C
V 2	C	V 59	C
V 3	C	V 61	C
V-4	C	V 64	0
V 5	C	AV 65	C
V-6	C	V 66	C
V 7	C	V 67	C
AV 8	C	AV 80	C
AV 9	C	V 81	C
V 10	0	V 82	0
AV 11	C	V 83	C
AV 12	C	V 84	C
AV 13	C	V 85	C
AV 14	C	V 86	0
AV 15	C	V 87	0
AV 16	C	V 88	C
AV 17	C	V 89	C
AV 18	C	V 90	C
AV 19	C	V 91	C
V 20	C	V 92	C
V 22	C	V 93	0
V 23	0	V 95	C
V 24	C	V 96	0
V 25	0	V 97	C
V 29	C	V 98	C
AV 30	C	V 99	C
V 31	0	V 100	0
V 33	C	V 101	C
V 34	C	V 102	C
AV 35	C	V 103	0
V 37	0	V 203	C
V 38	C	V 204	C
V 39	C	V 205	0
V-40	C	V 206	0
V-41	C	V 207	C
V 53	C		
V 54	0		
V 55	C		
V 57	C		

KEY 0 = OPEN C = CLOSED OAN = OPENED AS NEEDED

APPENDIX 4

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OPERABLE UNIT 2 SYSTEM VALVES

VALVE NO	SIZE/TYPE	MANUAL OR AUTO	LOCATION	FUNCTION
V-1	6 in BFLY*	M	Suction of PP-8-1	Feed to PP-8-1
V-2	6 in BFLY*	M	Discharge of PP-8-1	Feed to Top Train
V-3	6 in. BFLY*	M	Discharge of PP-8-1	Feed to Middle Train
V-4	6 in BFLY*	M	Discharge of PP-8-1	Feed to Bottom Train
V-5	6 in. BFLY*	M	Module Train Discharge	Discharge from Top Train
V-6	6 in. BFLY*	M	Module Train Discharge	Discharge from Middle Train
V-7	6 in. BFLY*	M	Module Train Discharge	Discharge from Bottom Train
AV-8	2 in BALL	A	Bottom Train Discharge	Cleaning Inlet
AV-9	2 in BALL	A	Top Train Inlet	Cleaning Outlet
V-10	2 in BALL -	M	Cleaning Pump CP-1	Cleaning Pump Discharge
AV-11	2 in BALL	A	Cleaning Pump Discharge	Cleaning Return to TK1 and 2
AV-12	2 in. BALL	A	TK-9	CP-1 Pump Suction
AV-13	2 in BALL	A	TK-10	CP-1 Pump Suction
AV-14	2 in BALL	A	TK-9	TK-10 Fill Inlet
AV-15	2 in BALL	A	TK-9	TK-9 Cleaning Return
AV-16	2 in BALL	A	TK-9	TK-9 Filtrate Return
AV-17	2 in. BALL	A	TK-10	TK-10 Cleaning Return
AV-18	2 in BALL	A	TK-10	TK-10 Filtrate Return
AV-19	3 in BFLY	A	Filtrate to Neutralization	Filtrate Open/Close
V-20	2 in BALL	M	TK-9 and TK-10	TK-9 and TK-10 Drain
V-22	2 in BALL	M	TK-8 Drain	TK-8 Drain
V-23	2 in BALL	M	Sludge Pump	Sludge Pump Suction
V-24	2 in BALL	M	TK-11	TK-11 Drain
V-25	2 in BALL	M	TP-11-1 Inlet	TP-11-1 Suction
V-29	2 in BALL	M	TP-11-1	Flow Control to GAC
AV-30	2 in BALL	A	Top Train Inlet	Cleaning Return to TK-8
V-31	2 in BALL	M	TP-11-2	TP-11-2 Feed

* = Butterfly

APPENDIX 4

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VALVE NO	SIZE/TYPE	MANUAL OR AUTO	LOCATION	FUNCTION
V-33	2 in BALL	M	TK-9	Chemical Fill
V-34	2 in BALL	A	TK-10	Chemical Fill
AV-35	2 in BALL	M	Filtrate above PP-8-1	Filtrate Return to TK-8
V-37	1/2 in BALL	M	Seal Water Filter	Seal Water Filter Isolation
V-38	2 in BALL	M	TP-11-1	Trailer No 1 Water Supply
V-39	2 in BALL	M	TP-11-1	Trailer Hose Down
V-40	2 in BFLY*	M	Bottom Train No 1	Train No 2 Isolation
V-41	2 in BFLY*	M	Middle Train No 2	Train No 3 Isolation
V-55	2 in BALL	M	Effluent from TK-6	Drain
V-57	2 in BALL ~	M	Effluent from TK-5	Drain
V-58	1 in BALL	M	Effluent from TK-5	Influent to Acid Metering
V-59	1 in BALL	M	Influent to TK-4	TK-4 Fill Water
V-61	1 in BALL	M	Top of TK-6	Lime Tank Water Fill
V-64	1/2 in BALL	M	Top of TK-1	Acid Delivery
V-65	1 1/2 in BALL	M	Top of TK-2	Lime Delivery
V-66	2 in BALL	M	Bottom Left Side, TK-1	Drain
V-67	2 in BALL	M	Bottom Right Side, TK-2	Drain
AV-80	1 1/2 in BALL	A	Effluent from TK-11	Filtrate Discharge Flow
V-81	1/2 in BALL	M	Influent to TK-2	Sulfuric Acid Injection
V-82	1 in BALL	M	Effluent from Seal Water Pump	Distribute Seal Water
V-83	3 in BALL	M	West End of T900A System	Drain for T900A
V-84	1 in BALL	M	Top of TK-5	Influent Water to TK-5
V-85	1 in BALL	M	Influent Water to Lime Pump	Lime Line Flush
V-86	1 in BALL	M	Effluent from TK-6	Lime Pump Suction Isolation
V-87	1 in BALL	M	Effluent from Lime Pump	Lime Pump Discharge Isolation

* = Butterfly

APPENDIX 4

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VALVE NO	SIZE/TYPE	MANUAL OR AUTO	LOCATION	FUNCTION
V-90	1 1/2 in BALL	M	Sludge Press	Effluent Sludge Filtrate
V-91	1 1/2 in BALL	M	Sludge Press	Effluent Sludge Filtrate
V-92	2 in BALL	M	Effluent from Sludge Wilden Pump	Dram
V-93	2 in BALL	M	Sludge Pump Suction	Sludge Pump Suction Isolation
V-94	3 in BALL	M	West End of T900B System	Dram for T900B
V-95	2 in. BALL	M	Influent to TK-1	Influent Isolation
V-96	2 in GATE	M	Influent to TK-1	Flow Adjust to TK-1
V-97	1/2 in BALL	M	Influent Air to Filter Press	Blow Down Filter Press
V-98	2 in BALL	M	TK-11 Filtrate Recirculation to TK-8	Recirculation from TK-11 to TK-8
V-99	2 in BALL	M	Effluent from TK-11	Recirculate TK-11
V-100	3 in GATE	M	Membrane Discharge	Control Flow to TK-11
V-101	2 in BALL	M	Above TK-2	Cleaning Pump Discharge to TK-2
V-102	2 in BALL	M	Above TK-2	Cleaning Pump Discharge to TK-2
V-103	3/4 in BALL	M	Influent to TK-12	TK-12 Flush Line
V-200	2 in BALL	M	Influent Line to GAC Adsorbers	Processed Water into GAC
V-201	2 in BALL	M	Effluent from EQ** Tank	Influent to TK-1
V-202	3 in BALL	M	Effluent Line to EQ** Tank (not in use)	Influent to Pump or Sock Filters
V-203	2 in BALL	M	Influent Line to GAC Adsorbers	Recirculation to EQ** Tank
V-204	2 in BALL	M	Influent Line to GAC Adsorbers	Recirculation to EQ** Tank
V-205	PRESSURE RELIEF	M	Influent Line to GAC Adsorbers	GAC Pressure Adjustment
V-206	3 in BALL	M	Treated Effluent Line before GAC A	Treated Effluent Discharge

** = Equalization

APPENDIX 4

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VALVE NO	SIZE/TYPE	MANUAL OR AUTO	LOCATION	FUNCTION
V-207	3 in BALL	M	Return Line to EQ** Tank before GAC A	Effluent Return to EQ** Tank
V-208	3 in BALL	M	Treated Effluent Line before GAC A	Influent to GAC A
V-209	3 in BALL	M	Return Line to EQ** Tank before GAC A	Backwash Return to EQ** Tank
V-210	3 in BALL	M	Middle Line GAC Piping	Isolation Valve
V-211	3 in BALL	M	Treated Effluent Line between GAC A and B	Effluent from GAC A
V-212	3 in BALL	M	Return to EQ** TK between GAC A and B	Backwash or Rupture Disk Return to EQ**
V-213	3 in BALL	M	Treated Effluent Line between GAC A and B	Influent to GAC B
V-214	3 in BALL	M	Return to EQ** TK between GAC A and B	Backwash Return to EQ** Tank
V-215	3 in BALL	M	Treated Effluent Line in front of GAC B	Treated Effluent Discharge
V-216	3 in BALL	M	Return to EQ** TK in front of GAC B	Backwash or Rupture Disk Return to EQ**
V-217	3 in BALL	M	Treated Effluent Line between GAC B and C	Effluent from GAC B
V-218	3 in BALL	M	Return to EQ** TK between GAC B and C	Backwash or Rupture Disk Return to EQ**
V-219	3 in BALL	M	Treated Effluent Line between GAC B and C	Influent to GAC C
V-220	3 in BALL	M	Return to EQ** TK between GAC B and C	Backwash or Rupture Disk Return to EQ**
V-221	3 in BALL	M	Treated Effluent Line in from of GAC C	Treated Effluent Discharge
V-222	3 in BALL	M	Return to EQ** TK in front of GAC C	Backwash or Rupture Disk Return to EQ**

** = Equalization

APPENDIX 4

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VALVE NO	SIZE/TYPE	MANUAL OR AUTO	LOCATION	FUNCTION
V-223	3 in BALL	M	Treated Effluent Line between GAC C and D	Effluent from GAC C
V-224	3 in BALL	M	Return to EQ** TK between GAC C and D	Backwash or Rupture Disk Return to EQ**
V-225	3 in BALL	M	Treated Effluent Line between GAC C and D	Influent to GAC D
V-226	3 in BALL	M	Return to EQ** TK between GAC C and D	Backwash Return to EQ** Tank
V-227	3 in BALL	M	Treated Effluent Line in front of GAC D	Treated Effluent Discharge
V-228	3 in BALL	M	Return to EQ** TK in front of GAC D	Backwash or Rupture Disk Return to EQ**
V-229	3 in BALL	M	Treated Effluent Line after GAC D	Effluent from GAC D
V-230	3 in BALL	M	Return Line to EQ** Tank after GAC D	Effluent Return to EQ** Tank
V-231	3 in BALL	M	Treated Effluent Line after GAC D	Final Effluent Discharge
V-232	3 in BALL	M	Return Line to EQ** Tank after GAC D	Final Effluent Return to EQ** Tank

** = Equalization